CodeQuilt: Designing an *Hour of Code* Activity for Creative and Critical Engagement with Computing

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ABSTRACT

As one of the largest initiatives to introduce K-12 youth to computing, the *Hour of Code* has reached hundreds of millions of students around the globe. While *Hour of Code* activities have been immensely successful, they have also been criticized for their focus on puzzle-like close-ended guided activities leaving out more creative and critical engagement with computing. In this paper, we report on efforts to design CodeQuilt, an Hour-of-Code-style activity in which middle and high school youth were asked to design Scratch projects that engage with issues on who and what is computing. We analyzed over 100 Scratch projects posted on the public CodeQuilt site in addition to reflective responses provided by participating youth. We found that a wide array of Scratch projects engaged creatively by integrating popular media but only a small number of projects focused on critical issues. In the discussion, we outline next steps for better supporting more critical and creative engagement with computing in *Hour of Code* activities.

CCS CONCEPTS

• **Social and professional topics → K-12 education**.

KEYWORDS

Critical computing education, Hour of Code, Scratch, programming

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1 INTRODUCTION

The *Hour of Code* (hereafter: HoC) is an annual event that offers hour-long activities to introduce K-12 youth to computing [17], taking a first stab at "unlocking" the proverbial locked doors to the clubhouses of computing [8]. By any measure, the outreach of HoC achieved over the last eight years has been an unprecedented success but not without criticisms in regard to its focus on puzzle-like, close-ended, lock-step guided activities (e.g., [15, 16]). The purpose of this pilot study is to examine how an hour-long, HoC-style activity can expand its introduction to computing to promote creativity as well as allow for critical reflection of the many ethical and political challenges in the field. The design of CodeQuilt presents an effort to engage grades 6-12 students in examining the purposes and players of computing while also providing a hands-on introduction to computing content and practices. We report on the implementation of CodeQuilt during HoC week in a large U.S. public school district, in which students were asked to reflect on who and what is computing while learning to code Scratch projects. The analysis focused on over 100 Scratch project designs posted on the public CodeQuilt site, and reflective responses from participating youth to address the following research question: In which ways did CodeQuilt promote creative and critical engagement with computing? Our goal is to better understand and develop design directions for expanding creative and critical engagement with computing in HoC activities.

2 BACKGROUND

Most current HoC efforts are focused on introducing students and teachers to computing with little attention being paid to the equally important creative and cultural narratives that are inextricably linked to CS identities—narratives which currently emphasize career and college applications [15] rather than civics and creativity. One early concern has been the lack of creative computing [10] which situates students' introductions to computing by leveraging personal interests and prior experiences in designing popular applications, games and stories. This emphasis on creative computing also resonates with criticisms of schooling which imagination repressed in classrooms that are steeped in dominator culture because the aim is to conform students to the status quo of a particular cultural group [4].

A more recent concern has been the absence of stories that highlight students' civic and ethical connections and continue to perpetuate exclusive cultural stereotypes and inequities in computing.

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Here efforts towards critical computing have moved beyond inclusion and representation and focus on justice and deeper engagement by taking into account the political and ethical dimensions of computing [14]. In critical computing activities, students are often asked to address existing real-world challenges by creating original multimedia artifacts, accounting for socio-cultural and political contexts as well as centering the implications, consequences, and limitations of computing [5, 14]. Student-generated projects include, for example, mapping visualizations that highlight local issues with gentrification [7], and mobile apps that challenge existing narratives about 'low-resource' neighborhoods by highlighting local, accessible extracurricular activities students catalogued for their peers [14]. Most of the current critical computing through restorying efforts engage students in long term projects while creating and coding their narratives (e.g., [2, 12].

For CodeQuilt, we wanted to emphasize both creative and critical engagement and thus adopted the *restorying* approach [13], an analytical framework that has been successfully employed to understand how teachers and students reshape narratives to represent diverse and often marginalized perspectives and experiences lost in mainstream digital media. The restorying approach was developed to better understand how relationships between readers-writers-texts are transformed through the use of new media tools and platforms. We suggest that these relationships are characterized by a struggle over meaning, as young people who are not represented in dominant narratives push back, using digital media and counterstorying practices, to highlight the central role identity plays in all interpretive acts [13].

In developing and implementing CodeQuilt, we introduced creative and critical engagement with computing by providing youth with a hands-on coding experience while also inviting them to restory the ongoing dominant narratives around *who is computing and what is computing*. In addition, we aimed to situate the products of this critical engagement in a public context by using the quilt as a metaphor for illustrating how various projects come together to create a joint message of solidarity. By selecting a "quilt" as an organizing format we are building on the use of quilts for conceptualizing marginalized cultural identity and representing histories in Black, LGBTQ, and women communities. Rather than containing design and discussions to individual classrooms, contributing to a public display meant letting youth not only create but also share their designs with a larger audience, capturing a diversity of issues and voices reimagining what computing is and could be.

2.1 Research Context

2.1.1 Participants. We designed the CodeQuilt activity for a large U.S. East Coast school district to adopt an "HoC"-style activity while participating in CS Education Week in December 7-12, 2020. Initially over 100 middle and high school teachers from the school district expressed interest in participating in the event by signing up with a local organization. Due to COVID-19 and IRB limitations, we could not visit or observe any classrooms nor interview any students or teachers about their participation and experiences.

2.1.2 Designing CodeQuilt. We modeled the design of CodeQuilt after other HoC activities. We provided an activity overview and step-wise guidance for teachers to facilitate the HoC, including prompts for whole class discussions and reflections, and scaffolds to support quilt patch design and programming. These included introductory questions such as "What comes to your mind when we say coding or computer programming and coders or computer programmers?" followed by a brief overview of Scratch. Students were prompted to create a patch that addressed questions, observations, and concerns they have about who gets to code, what is being programmed, and what kind of stories are being told about computing in popular culture. At the end of the hour-long activity, students and teachers were invited to upload and post their quilt patches i.e., Scratch projects, in a public Scratch studio. We also developed a website (http://codequilt.herokuapp.com/) that automatically pulled all projects from the Scratch Studio site and populated the "quilt" (see Figure 1, right). Participants across classrooms and schools could view the collective quilt at the beginning of the activity for inspiration. At the end of the activity, they could see their contribution to the larger CodeQuilt and reflect on different themes across the projects. All of these components were imported into Codio, an online platform adopted by the host school district for computer science activities.

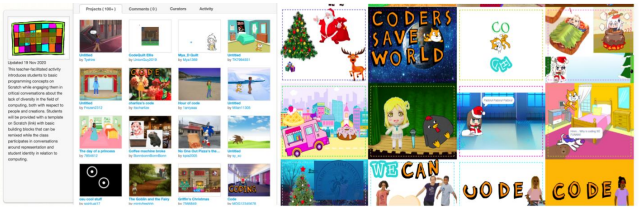

Figure 1: Sampling of projects displayed in the Scratch Studio (left) and pulled into the CodeQuilt website (right).

2.1.3 Data Collection and Analysis. We focused our data collection and analyses on the publicly available quilt patches from the CodeQuilt website, supplemented with student responses in the Codio platform to the reflective prompt: "Take a look at the quilt (http://codequilt.herokuapp.com/). What do you see across all the stories? Anything standing out? Anything still missing? What are 1-2 things you learned making these patches and the quilt?". The third and the fourth authors independently coded all 119 projects shared on the CodeQuilt studio examining each project for its creative and critical content. Projects with ambiguity were discussed and new categories were generated to accommodate them. A total of 158 end-of-activity student reflections from CodeQuilt, usually 1-2 sentences, were analyzed qualitatively by the first and the second authors to capture the overall sentiment students expressed about the activity.

3 FINDINGS

Our analysis revealed that in terms of creative engagement, participants mostly expressed personal interests in their quilt patches. The projects on the CodeQuilt Scratch studio covered a wide range of themes and aesthetic influences. We categorized the projects into the following themes: animals (34.5%), pop culture characters and references (23.5%), recreational activities (11.8% such as playing sports, dancing, enjoying food), and holidays (10.9%). Further,

participants brought in their personal interests by remixing media. More than half of the projects (53%) remixed GIFs, images or music from popular culture. This creative engagement with remixing allowed students to connect with their personal interests by taking advantage of the open-ended nature of the CodeQuilt activity. Students also considered how other people would interact with their projects, 56% of CodeQuilt projects included instructions and notes for the audience that can be seen as a desire for others to interact and use their creations.

In terms of critical engagement, we observed that only 34 (28.6%) of these projects were related to coding. The instructions on the CodeQuilt website on Codio directed students towards designing a project that "takes ownership of their own stories about coding (stories often lost and ignored across apps, websites, and other digital media) by designing digital quilt patches". Only four projects reflected critical CS content related to who can code and why we code (see Figure 2). Examples of topics included women's empowerment, the personal significance of coding for a boy with disabilities, inclusion, and coding's many uses all over the world. However, none of the projects were critical of computing or addressed issues within computing as a field.

3.png

Figure 2: Sample of CodeQuilt Scratch projects.

An analysis of end-of-activity student reflections from the CodeQuilt revealed that a large majority of the students (82%) had a positive experience learning during this hour and called it a "fun" and an "interesting" activity. Many of them reported how easy it was to make a patch for the quilt, "messing around" with blocks while realizing simple quilt patches within the hour provided. Some students specifically commented that this would be a good activity for someone "new" to programming to get interested in computing. In addition to the ease of making these patches, many students expressed surprise and excitement to see the variety of quilt patches and ideas in the larger quilt, and to contribute to the same, highlighting the role of audience and collective purpose.

A few students also reflected on how this activity got them to engage with who programs and what artifacts get generated from programming. These students, at the end of the activity, reported that anyone could program and that they could code to express ideas beyond traditional games and puzzles, be creative and engage with social issues. A small proportion of the students (about 11%) were neutral or mixed in their reflections, calling the experience as both fun and confusing at the same time while even fewer (about 7%) reflected that this activity did not invite them to engage with programming or that it was very confusing. Overall, a majority of the participants were left with a positive sentiment, with a small proportion of them appreciating the opportunity to engage with critical aspects.

4 DISCUSSION

In this paper, we examined youth creative and critical engagement in Scratch projects in the context of an HoC-style activity. With CodeQuilt, we also took a first step in pulling together multiple projects in one public display, allowing youth to view and potentially discuss each other's contributions. We know from student reflections that they were motivated by the quilt, drew examples from the quilt, and felt proud to contribute to the collective effort. CodeQuilt provided a collective space in which students could engage with computing and tell their stories; in a few instances, they were also redefining or "restorying" mainstream narratives about coding and computing. The design of quilt patches and contributing to a collective display, on the wall or on the screen, can provide multiple perspectives and generate rich material for reflective discussion.

We also observed that a far larger number of projects posted in CodeQuilt engaged creatively while only a very small number of projects engaged with critical issues. What are possible explanations for this observation? For one, the pervasiveness of pop-culture and leisure activities as Scratch topics might signal how most youth think about their experiences with technologies and social media applications. Consequently, these are the first applications that come to mind when asked to think about computing. Likewise, the Scratch site and its studios feature mostly games and commercial content thus signaling to beginning users that this is the kind of content valued in the community [6, 11]. Furthermore, many public discussions about the lack of diversity, the presence of bias, and concerns about privacy are focused on adult and workplace issues—seemingly in a distant future for participating K-12 students. Most importantly, these observations suggest that we need to work closer with youth and prepare teachers to engage in the critical discussions about computing.

Moving forward, this study generated important insights for how we can design future introductory computing activities such as the HoC. First, we need to work on providing multiple examples for how to address topics of critical computing in HoC activities: who is coding, for whom are they coding, what and whose problem are they solving, and towards what ends, whom might their designs be marginalizing. One way to have available a larger number of examples would be to involve youth in co-designing the HoC activities and generate topics and issues related to critical computing that are of interest and concern to them [3]. The 2020 portfolio on the HoC site offers hundreds of activities involving different topics, likewise critical approaches should not be limited to one or two topics.

Second, we need to provide more extensive introductory materials for both students and teachers to make critical topics more accessible. We noticed that many of the HoC activities in the December 2020 Hour of Code were accompanied by short video trailers that introduce the activities and provide overviews of tools used. In addition to introducing the activity, this video can be used as an opportunity to present teachers with critical issues undergirding the activity, with examples to highlight the biases in technology designs and their implications for marginalized communities (e.g., [1]). From racist facial recognition softwares to automatic decision-making systems in job markets (e.g., [1, 9]), teachers can be briefly introduced to how technologies, designed to serve and maintain societal status quo, perpetuate inequity and injustice. Further, these trailers could also give examples of completed projects and even testimonials, making the activity and the integration of issues of justice in computing more accessible to teachers and students. These trailers could support teachers in starting and facilitating conversations around critical issues in computing.

Third, we need to prepare the community—teachers and students—to discuss sensitive topics in the context of computing. The presence of HoC activities and materials alone is not a guarantee that productive conversations around race and bias can happen within the short time from provided through HoC. A month before the start of CS Education Week, we should consider offering short workshops that will give teachers more background on recent conversations at the intersection of societal inequities and computing (e.g., [1, 9]) and provide the opportunity to examine HoC activities and develop their own projects and discussion guides.

One of the reasons why promoting creative and critical engagement even for introductory computing activities like HoC is important, is that these activities have often been the first encounter with code for hundreds of millions of youth globally. The range of HoC activities offered, thus, signals to youth what is considered relevant and representative in computing, in which ways computing can solve but also raise issues, and which topics should be of societal concern. Furthermore, activities addressing critical issues should not remain discussion material alone but connected to coding itself. Some might argue that topics of representation, bias and diversity are beyond the purview of K-12 participants, more appropriately addressed with more informed and mature student audiences. But we argue that these critical conversations have to start early, coupled with the introduction to technologies. If we are to imagine futures beyond our current structural inequities and how they are encoded in our society [1], we need to show youth the transformative and creative potentials of code. We not only need to help youth learn how to code but also prepare them to understand and confront the challenges associated with digital technologies that structure and permeate the digital publics.

5 SELECTION AND PARTICIPATION OF CHILDREN

No children actively consented to participate in this research, as only non-identifying information was collected from students who voluntarily engaged in the CodeQuilt activity as part of their school assignment. Only non-identifiable information was collected and analyzed from projects posted in the publicly accessible Scratch Studio and the Codio platform responses. Research was approved by the University's IRB.

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